

Work Order ID 142450

Wednesday, March 09, 2016 2:59:16 PM

142450

Page 1

SEE W/O 129473

Item ID: D350-748-143TRN Accept ***N900040100*** Setup Start ***NS1***
 Revision ID: Stop ***NS2***
 Item Name: SS Crosstube Turning Detail
 Start Date: 3/10/2016 Start Qty: 1.00 ***1*** Cust Item ID:
 Required Date: 3/14/2016 Req'd Qty: 1.00 ***1*** Customer:
 Reference: STARTED ON W/O129473

Approvals: Process Plan: [Signature] Date: 16-3-9 Tooling: _____ Date: _____ Run Start ***NR1***
 QC: _____ Date: _____ SPC (Y/N): _____ Date: _____ Stop ***NR2***

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
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Draw Nbr	Revision Nbr
D350-748-143	A

150 Large Fab 0.00

150

Crosstubes

Crosstubes

Memo

1-Grind machining marks

THIS WAS STARTED ON W/O 129473
 W/O WAS CLOSED BEFORE ITEM WAS FINISHED.

BL 16/03/16

190 Packaging 0.00

190

Packaging

Packaging

Memo

Identify and stock in kanban rack
 Location: 1603

BL 16/03/16

200 QC21- Final Inspection - Work Order Release 0.00

200

QC

Quality Control

Memo

Receive under New Batch
16-3-9

MUS MAR 21 2016

DQA: _____ Date: _____



WORK ORDER NON-CONFORMANCE / UPDATE

QA Closed: _____ Date: _____

Work Order update only ☐

Work Order: _____ Part No. _____ NCR No. _____		DISPOSITION Rework ☐ Scrap ☐ Use-as-is ☐ Suspected Unapproved ☐		AGAINST DEPARTMENT/PROCESS Skid-tube ☐ Machining ☐ Thermoforming ☐ Large Fab ☐ Cross tube ☐ Small Fab ☐ Finishing ☐ Composite ☐ Water Jet ☐ Prod. Eng. Coord. ☐ Rec/Store/Packaging ☐ Supplier ☐ Engineering ☐ Quality ☐ Other ☐					
Date :		Step #:		QTY Effective :			MRB (QSI042) Approval		
Description Work Order Deviation				Disposition				Completed By Lead hand / Supervisor Approval Verification QC / QA Coordinator Approval	
Root Cause		FAULT CATEGORY							
Environment ☐	☐	No Re-verification ☐	Pressure/Forced ☐	Temperature/Cure ☐	Power Loss/Surge ☐	Positioned Wrong ☐			
Design ☐	☐	Operator ☐	Bending ☐	Set-up ☐	Folio/Program ☐	Outside Dimensions ☐			
Doc/Data ☐	☐	Offset/Setup ☐	Centre Not Concentric ☐	BOM/Route ☐	Grain ☐	Over/Under tolerance ☐			
Equip/Tooling ☐	☐	Supplier ☐	Cracks ☐	Broken/Damage/Defect ☐	Weld ☐	Part Incorrect ☐			
Handling/Pre ☐	☐	Training ☐	Crimp/Kink/Ripple/Wave ☐	Inspection Incomplete/Unqualified ☐	Wrong Stock Pulled ☐	Part Lost/Missing ☐			
Material ☐	☐	Use for Testing ☐	Cuffs ☐	Contamination ☐	Out of Sequence ☐	Part Moved ☐			
Internal Transport ☐	☐	Poor Information ☐	Crushing ☐	Countersink ☐	Off-set ☐	Drawing ☐			
Tribal Knowledge ☐	☐	Rushing ☐	Heat Treat ☐	Cut Too Short ☐	Mislabeled ☐	Finish ☐			
LOA ☐	☐	Product Improvement ☐	Wave/Twist in Tube ☐	Instructions Incomplete/Unclear ☐	Fit/Function ☐	Misread ☐			
Substation ☐	☐	Process Improvement ☐	Marks/Chatter ☐	Drill Holes ☐	Misaligned/off center ☐	Turning Sequence ☐			
Past Expiry Date ☐	☐	Manufacturing Process ☐							
Misidentified ☐	☐	Past Due ☐	OTHER :						

Work Order ID 129473

February-11-15 3:22:19 PM

129473

SEE W/O 142450

Page 1

Item ID: D350-748-143TRN

Accept

N9000040100

Setup Start

NS1

Revision ID: PRELIM

Item Name: Crosstube Turning Detail

Stop ***NS2***

Start Date: 2/11/15 Start Qty: 1.00

1

Cust Item ID:

Required Date: 3/04/15 Req'd Qty: 1.00

1

Customer:

Reference:

Approvals:

Process Plan:

Date:

Tooling:

Date:

Run Start

NR1

QC:

Date:

SPC (Y/N):

Date:

Stop

NR2

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
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Draw Nbr

Revision Nbr

D350-748-143

PA2 Rev A

105

0.00

105

Purchasing

Purchasing

Memo

0.00

ISSUE PO TO TUBE HOLLOWS
PO 27398

EXTRUDED TUBE D6021 REV. PA5
17-4 H1025 SEAMLESS STEEL TUBE AS PER ASTM A564
SIZE 2.378"OD X 2.00"ID X 125"LONG
MIN UTS = 155KSI
MIN YTS = 145KSI

TURN PER DRWG D350-748-143 REV.PA2

- 1-Fill tube with sand & install plugs on both ends as per Folio
 - 2-Turn first side as per Folio
 - 3- File transition lines smooth.
 - 4-Turn second side as per Folio
 - 5- File transition lines smooth.
 - 6-Scribe Part & Batch as per Dwg D350-748-143
- PER DRWG - FINISH LENGTH AFTER TURNING = 112.270 +/- 0.06

CL 15/02/12 ①

Work Order ID 129473***129473***

Page 2

February-11-15 3:22:19 PM

Item ID: D350-748-143TRN

Accept

N900040100Setup Start ***NS1***

Revision ID: PRELIM

Item Name: Crosstube Turning Detail

Stop ***NS2***

Start Date: 2/11/15 Start Qty: 1.00

1

Cust Item ID:

Required Date: 3/04/15 Req'd Qty: 1.00

1

Customer:

Reference:

Approvals: Process Plan: _____ Date: _____ Tooling: _____ Date: _____

Run Start ***NR1***

QC: _____ Date: _____ SPC (Y/N): _____ Date: _____

Stop ***NR2***

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
--------------------------------	--------------------------	----------------------	---------	--------	--------------	---------------	---------------	------------------	----------------

115 Receive & Inspect for Damage & Mat'l Certs

0.00

115

Packaging

Memo

0.00

Packaging

CL 15/04/14 ①

125 QC1- Inspect dimensions to dimension sheet

0.00

125

QC

Memo

0.00

Quality Control

L Ø

DAS
49
9-89

150 Large Fab

0.00

150

Crosstubes

Memo

0.00

Crosstubes

1-Grind machining marks

15/06/30

Work Order ID 129473

February-11-15 3:22:19 PM

129473

Page 3

Item ID: D350-748-143TRN Accept ***N900040100*** Setup Start ***NS1***
 Revision ID: PRELIM Stop ***NS2***
 Item Name: Crosstube Turning Detail
 Start Date: 2/11/15 Start Qty: 1.00 ***1*** Cust Item ID:
 Required Date: 3/04/15 Req'd Qty: 1.00 ***1*** Customer:
 Reference:

Approvals: Process Plan: _____ Date: _____ Tooling: _____ Date: _____ Run Start ***NR1***
 QC: _____ Date: _____ SPC (Y/N): _____ Date: _____ Stop ***NR2***

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
190	Packaging	0.00							
100									
Packaging	Memo	0.00							
Packaging	Identify and stock in kanban rack Location: _____								
200	QC21- Final Inspection - Work Order Release	0.00							
200									
QC	Memo	0.00							
Quality Control									

CL15/04/14

POSITIVE RECALL
 EFFECTIVE 1502.11 AUTH
 RELEASED 15-1229 DATE DAS
 9-89

Rev A
 ECN 15-547

February-11-15 3:23:17 PM

Parent Item: D350-748-143TRN

Parent Item Name: Crosstube Turning Detail

129473

D350-748-143TRN

Start Date: 2/11/15**Required Date:** 3/04/15**Start Qty: 1.00**

Required Qty: 1.00

Comments: NEW ISSUE - PRELIM - LL 12.05.08

Component Item ID/ Item Name	Replacement Item ID	Mfg/ Purch	Bin Item	Primary Location	Last Location	Route Seq ID	Unit of Measure	Qty on Hand	Qty per Kit	Total Qty	Qty Issued	Date Issued	Status
D350-748-143TRNP		Purchased		No			Each	0.0000		1			
D350-748-143TRNP													
Crosstube Material - 17-4PH													
D6021-125P		Purchased		No			Each	0.0000		1			
D6021-125P													
Crosstube Material - 17-4PH													

Item	Qty -143	Part Number	Description
	X	D350-748-143	CROSSTUBE ASSEMBLY (AS 350/355 HI FWD)
1	1	D6021-125	CROSSTUBE
2	2	D3502-1	SUPPORT
3	2	D5123-7	CLAMP CUSHION
4	1	AETC-1032	INSERT
5	1	NAS1149C0363R	WASHER (OR AN960C10)
6	2	MS21920-20 OR MS21920-21/-22	CLAMP (PER DART SPEC. M-MS21920-20/-21/-22)
7	1	AN526C1032R9	SCREW
8	A/R	PROSEAL 890 B-2	SEALANT, AMS-S-8802 CLASS B-2

GENERAL NOTES:

- 1) MATERIAL: MANUFACTURED FROM D6021-125 (17-4PH)
FINISHED LENGTH AFTER TURNING = 112.270±0.08 (AFTER BENDING/TRIMMING = 110.27 REF)
- 2) FINISH: PRIME INSIDE AND OUTSIDE PER DART QSI 005 4.2
PAINT OUTSIDE PER DART QSI 005 4.2
- 3) TOLERANCE: PER DART QSI 018 UNLESS OTHERWISE NOTED.
WALL THICKNESS ECCENTRICITY PER DART QSI 038 7.2
MIN. ALLOWABLE WALL IS -0.020 FROM NOMINAL
- 4) UNITS: INCHES UNLESS OTHERWISE NOTED.
- 5) BREAK SHARP EDGES: 0.005 TO 0.010 MAX.
- 6) IDENTIFICATION: DART PART NUMBER "D350-748-143" AND BATCH NUMBER ON INSIDE OF CUFF
PER DART QSI 044 6.4 (VIBRATING STYLUS)
- 7) WEIGHT: 30.45 lbs
- 8) PART IS SYMMETRIC ABOUT CENTERLINE, EXCEPT FOR Ø0.290 HOLE.
- 9) EXTREME CARE MUST BE TAKEN TO PROTECT THE OUTSIDE SURFACE OF THE TUBE. THE OUTSIDE SURFACE MUST BE SMOOTH AND FREE FROM SURFACE DEFECTS SUCH AS SCRATCHES, NICKS, OR DENTS. DEFECTS UP TO 0.005" MAY BE BLENDED OUT LONGITUDINALLY. CIRCUMFERENTIAL GRIND MARKS ARE UNACCEPTABLE. WHEN DRILLING HOLES EXTREME CARE MUST BE TAKEN AND CAREFUL DEBURRING PERFORMED TO ENSURE A CLEAN HOLE WITH NO CRACKING/CHIPPING/GROOVES.

TURNING

- 10) BLEND OUT ALL EDGES FROM MACHINING LONGITUDINALLY, TRANSITION SHOULD BE SMOOTH. NOTE: ALL HOLES ARE DRILLED AFTER BENDING.

BENDING

- 11) BEND PROGRESSIVELY WITH A MINIMUM OF 7 PASSES PER SIDE. MAXIMUM TUBE FLATTENING DUE TO BENDING IS 6% BASED ON O.D. ON TOP HALF OF BEND, AND 7% ON BOTTOM HALF OF BEND.
- 12) MAX AMPLITUDE OF RIBBLING ALONG BENT PORTION OF THE TUBE IS 0.030 (ZN A1-3)
- 13) MAX TWIST: WITH XTUBE LAYED FLAT ON SURFACE, THE DIFFERENCE BETWEEN CUFF HEIGHTS FROM THE SURFACE MAY BE NO LARGER THAN 0.38 (ZN C1-3).

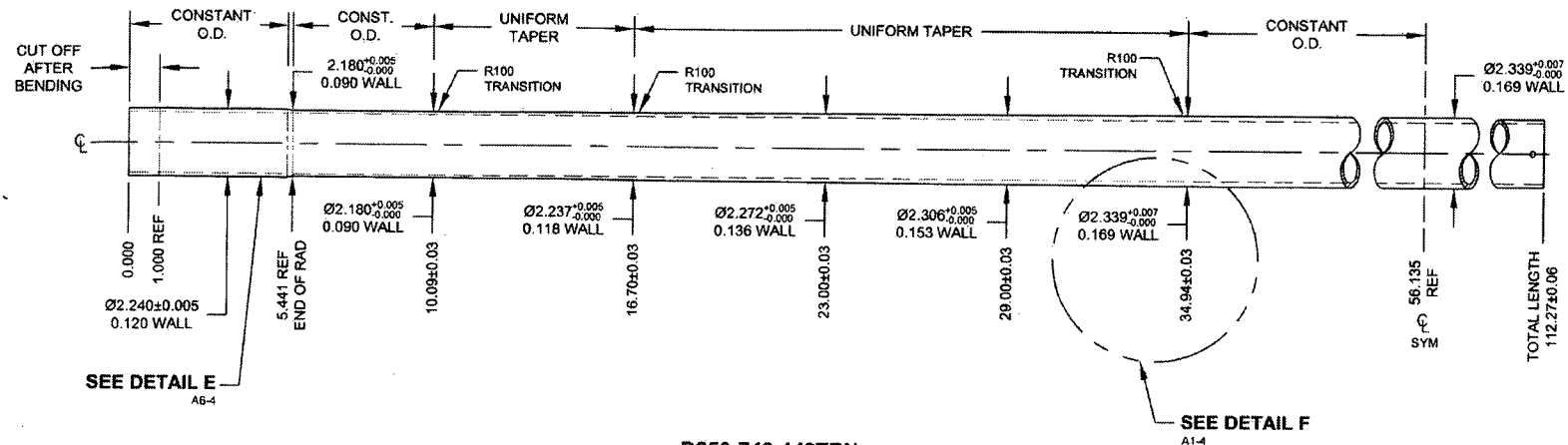
ASSEMBLY

- 14) TO INSTALL D3502-1 SUPPORT: ABRASE MATING SURFACE OF SUPPORT AND CROSSTUBE WITH 180-GRIT SANDPAPER AND REMOVE RESIDUE WITH MEK (OR EQUIVALENT). APPLY A 0.02" TO 0.05" THICK LAYER OF PROSEAL 890 CLASS B-2 (OR AMS-S-8802 CLASS B-2) SEALANT TO MATING SURFACE OF SUPPORT.
- 15) TORQUE CLAMPS 60 TO 80 IN-LB. ENSURE AT LEAST 1.5 THREADS SHOWING IN SAFETY AND THAT NUT HAS NOT BOTTOMED-OUT AFTER TORQUING. PRIOR TO PACKAGING, RE-CHECK TORQUE ON CLAMPS AFTER PROSEAL 890 SEALANT HAS CURED FOR 72 HOURS.

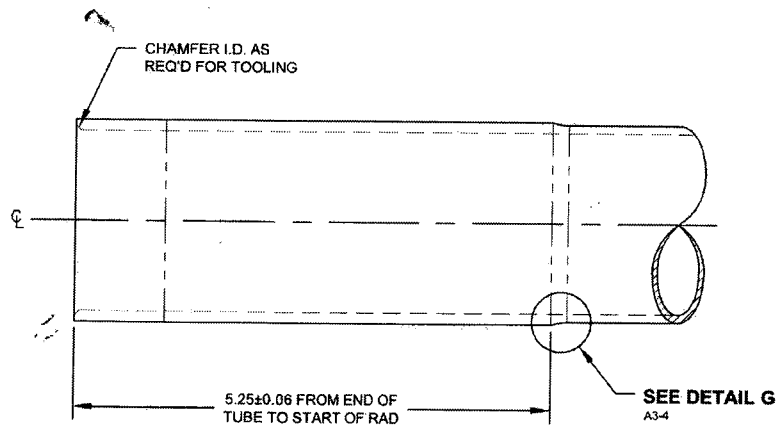
**PRELIMINARY
ISSUE**

Rev. P12

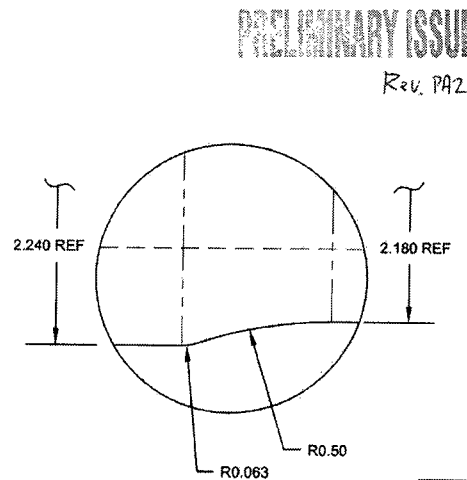
A	NEW ISSUE	CP	14.11.17
REV.	DESCRIPTION	BY	DATE
DESIGN	AP	DART AEROSPACE LTD HAWKESBURY, ONTARIO, CANADA	
DRAWN	AP		
CHECKED	AP	DRAWING NO.	REV. A
MFG. APPR.		D350-748-143	SHEET 1 OF 4
APPROVED		TITLE	SCALE
DE APPR.		CROSSTUBE (AS 350/355 HI FWD)	NTS
DATE	14.11.17	COPYRIGHT © 2014 BY DART AEROSPACE LTD THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL AND IS SUPPLIED ON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED FOR ANY PURPOSE OR COPIED OR COMMUNICATED TO ANY OTHER PERSON WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD.	



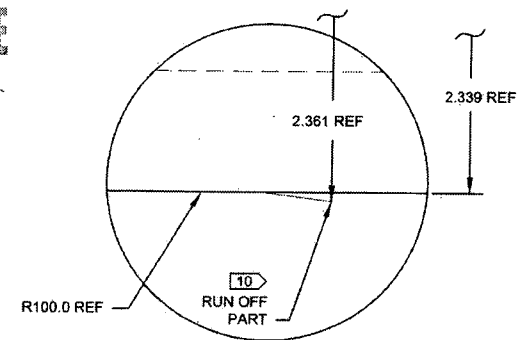
**D350-748-143TRN
TURNING DETAIL**



**DETAIL E:
CROSSTUBE CUFF**
SCALE 3X



**DETAIL G:
CUFF TRANSITION**
NOT TO SCALE



**DETAIL F:
TOOL RUN-OFF**
NOT TO SCALE

DESIGN	<i>40</i>	DART AEROSPACE LTD	
DRAWN	<i>40</i>	HAWKESBURY, ONTARIO, CANADA	
CHECKED		DRAWING NO.	REV. A
MFG. APPR.		D350-748-143	SHEET 4 OF 4
APPROVED		TITLE	SCALE
DE APPR.		CROSSTUBE (AS 350/355 HI FWD)	NTS
DATE	14.11.17	COPYRIGHT © 2014 BY DART AEROSPACE LTD	
THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL AND IS SUPPLIED ON THE EXPRESS UNDERSTANDING THAT IT IS NOT TO BE USED FOR ANY PURPOSE OR COPIED OR COMMUNICATED TO ANY OTHER PERSON WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD.			

PACKING LIST



39 Enterprise Drive # 2 Windham, ME 04062
Phone 207.892.8899 Fax 207.892.8863

Packlist ID: 01303
Date: 4/2/2015
Page: 1

Sold To Address

DART AEROSPACE LTD.
1270 ABERDEEN ST.
HAWKESBURY K6A 1K7
CANADA

Ship To Address

DART AEROSPACE LTD.
1270 ABERDEEN ST.
HAWKESBURY K6A 1K7
CANADA

			CUSTOMER PO		PAYMENT TERMS		F.O.B.	
			PO27398		Net 30		WINDHAM	
SALES REP ID			SHIPPING METHOD		SHIP DATE		OUR ORDER NUMBER	
			JOURNEY FREIGHT		4/2/2015		DAR150049	
QUANTITY								
ORD	SHF	BCK	PART ID		DESCRIPTION			

1.00 1.00 0.00

NON RECURRING ENGINEERING
Drawing:
Unit of Measure: EA
Legacy Part No.:

Rev No.:

1.00 1.00 0.00

CROSSTUBE, FWD
Drawing:
Unit of Measure: EA
Legacy Part No.:

Rev No.:

1 PIECE OF TUBE HOLLOW INTERNATIONAL SUPPLIED 17-4 PH MATERIAL.

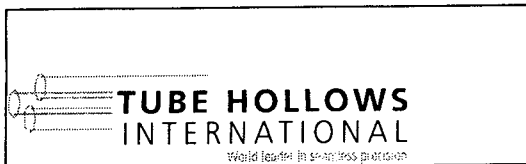
THE INITIAL MACHINING OF THE OD AND ID WERE DONE UNDER THI WO#:
141016/03 & DART PO#: PO24911 L/I 2.

S/N(S): T8D WAS CONVERTED TO PART# D350-748-143TRNP

THANK YOU FOR THIS ORDER.

RECEIVED BY: C 215/04/17

PACKING LIST



39 Enterprise Drive # 2 Windham, ME 04062
Phone 207.892.8899 Fax 207.892.8863

Packlist ID: 01303
Date: 4/2/2015
Page: 2

Sold To Address

DART AEROSPACE LTD.
1270 ABERDEEN ST.
HAWKESBURY K6A 1K7
CANADA

Ship To Address

DART AEROSPACE LTD.
1270 ABERDEEN ST.
HAWKESBURY K6A 1K7
CANADA

			CUSTOMER PO		PAYMENT TERMS		F.O.B.	
			PO27398		Net 30		WINDHAM	
SALES REP ID			SHIPPING METHOD		SHIP DATE		OUR ORDER NUMBER	
			JOURNEY FREIGHT		4/2/2015		DAR150049	
QUANTITY								
ORD	SHF	BCK	PART ID	DESCRIPTION				

1.00 1.00 0.00

CROSSTUBE, AFT
Drawing:
Unit of Measure: EA
Legacy Part No.:

Rev No.:

1 PIECE OF TUBE HOLLOWS INTERNATIONAL SUPPLIED 17-4 PH MATERIAL.

THE INITIAL MACHINING OF THE OD AND ID WERE DONE UNDER THI WO#:
141016/03 & DART PO#: PO24911 L/I 2.

S/N(S): B8F2 WAS CONVERTED TO PART# D350-748-243TRNP

THANK YOU FOR THIS ORDER.

RECEIVED BY: C 215/04/14



STATEMENT OF CONFORMANCE

Dart Aerospace Ltd.
1270 Aberdeen
Hawkesbury, ON K6A 1K7

Part #: D350-748-143TRNP ✓
Material: 17-4 PH
Report #: 5083150
Heat #: 053468
Drawing #: D350-748-143 Rev A
P.O #: PO27398 L/I 4
THI WO#: 150313/01
Qty: 1

SN: T8D

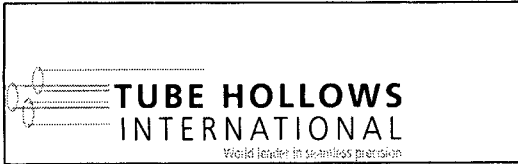
The above-mentioned parts have been inspected and conform to customer contract, purchase order, drawing, and other required specifications. All exceptions are noted below. Inspection data and all certifications are kept on file and available for review upon customer request.

Comments: None

Inspected / Certified By: Tom Bowker

Tom Bowker, Quality Dept. April 2, 2015

PACKING LIST



39 Enterprise Drive # 2 Windham, ME 04062
Phone 207.892.8899 Fax 207.892.8863

Packlist ID: 01302
Date: 4/2/2015
Page: 1

Sold To Address

DART AEROSPACE LTD.
1270 ABERDEEN ST.
HAWKESBURY K6A 1K7
CANADA

Ship To Address

DART AEROSPACE LTD.
1270 ABERDEEN ST.
HAWKESBURY K6A 1K7
CANADA

			CUSTOMER PO		PAYMENT TERMS		F.O.B.	
			24911		Net 30		WINDHAM	
SALES REP ID			SHIPPING METHOD		SHIP DATE		OUR ORDER NUMBER	
EVAN			CUSTOMER TRUCK		4/2/2015		DAR140195	
QUANTITY								
ORD	SHF	BCK	PART ID	DESCRIPTION				

56.00 2.00 16.00 D6021-125P

CROSSTUBE
Drawing:
Unit of Measure: EA
Legacy Part No.:

Rev No.:

2 PIECES OF TUBE HOLLOW INTERNATIONAL SUPPLIED 17-4 PH MATERIAL.

THE INITIAL MACHINING OF THE OD AND ID WERE DONE UNDER THI WO#:
141016/03 & DART PO#: PO24911 L/I 2.

THESE TWO PIECES WERE USED TO FULFILL L/I 4 & 5 OF DART PO#: PO27398.

S/N(S): T8D WAS CONVERTED TO PART# D350-748-143TRNP

S/N(S): B8F2 WAS CONVERTED TO PART# D350-748-243TRNP

THANK YOU FOR THIS ORDER.

CL15/04114

RECEIVED BY: _____



STATEMENT OF CONFORMANCE

Dart Aerospace Ltd.
1270 Aberdeen
Hawkesbury, ON K6A 1K7

Part #: D6021-125P ✓
Material: 17-4 PH
Report #: 5083150
Heat #: 053468
Drawing #: D6021 Rev. PA5
P.O #: PO24911 L/I 2
THI WO#: 141016/03
Qty: 2

SN: T8D, B8F2

The above-mentioned parts have been inspected and conform to customer contract, purchase order, drawing, and other required specifications. All exceptions are noted below. Inspection data and all certifications are kept on file and available for review upon customer request.

Comments: This is a partial shipment under this P.O.

Inspected / Certified By: Tom Bowker

Tom Bowker,

Quality Dept.

March 25, 2015

**VALBRUNA**SLATER STAINLESS, INC.
2400 TAYLOR STREET WEST - PO BOX 630
FORT WAYNE IN 46802 USA
PHONE 260.434.2800 - FAX 260.434.2801**Product Certification Report**Report Number: **5083150**

Certified on Dec 04, 2014 Page 1 of 2

Order I.D. 1402065 001		Order Date 7/31/14		Commodity Code	
Dim 1 2.5000	Dim 2 .0000	Dim 3 .0000	Heat I.D. 053468	Customer I.D. 001417	Customer Purchase Order P011200
Product Shape Rounds			Product Surface HR & Rough Turned		Customer Grade 17-4
Length (Inches) 132.000 Min. 156.000 Max.			Bill of Lading # 423604	Weight	

Ship To

Attention: Penn Stainless Prod
Tube Hollows International
39 Enterprise Dr.
Suite 2
Windham, ME 04062

Sold To

VALBRUNA STAINLESS, INC.
2400 TAYLOR STREET WEST
FORT WAYNE, IN 46802

Lifts: 0034 0035

Condition H-1025

ASTMA 564-13

MS-17-4H1025

CHEMICAL ANALYSIS

C	Mn	P	S	Si	Cr	Ni	Mo	Cu	N	Cb	Ta	Cb+Ta
.035	.64	.027	.025	.43	15.66	4.37	.25	3.26	.04	.26	.010	.270

ROCKWELL HARDNESS ASTM E18-14

HRC

35.0

TENSILE PROPERTIES ASTM E8-13a

TS (PSI)	.2%YS (PSI)	%EL(2")	%RA
161100	150100	21.0	59.4

CHARPY V NOTCH E23-12c

TEMP	FT/LB	FT/LB	FT/LB	LAT EX	LAT EX	LAT EX	AVG FT LB	AVG LAT EX
70	86	78	79	32	40	33	81	35

TEST(F)

70

MAGNETIC PARTICLE TEST AMS2303

FREQ SEV

AVG .00 .00

PRODUCTION HEAT TREATMENT

SOL-ANN(F)	SOL-ANN(HR)	QUENCH	AGE(F)	AGE(HR)	QUENCH
1900	6.00	Air	1025	4	Air

MACRO ASTM E340-13/E381-01

MACRO

OK

PERCENT FERRITE (AMS 2315)

% FERRITE Etchant Magnification X

AVG .3 Marbles 100

ULTRASONIC TEST (ASTM A388)

OK

Free of mercury and low melting alloy contamination.

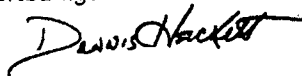
No welding or weld repair done.

Tensile specimen size .505".

Reduction ratio exceeds 5 To 1.

Results relate only to the items tested. Certification shall not be reproduced except in full, without written approval of Valbruna Stainless Inc. The recording of false, fictitious, or fraudulent statements on this document may be punished as a felony under federal statutes. Including Federal law Title 18, Chapter 47. Consult material safety data sheet (MSDS) for hazard info. I hereby certify that the reported figures are correct as contained in the records of the corporation.

Manager Laboratory Services



email: DHackett@valbruna.us

Dennis Hackett

**VALBRUNA****SLATER STAINLESS, INC.**2400 TAYLOR STREET WEST - PO BOX 630
FORT WAYNE IN 46802 USA
PHONE 260.434.2800 - FAX 260.434.2801**Product Certification Report**Report Number: **5083150**

Certified on Dec 04, 2014 Page 2 of 2

Order I.D. 1402065 001		Order Date 7/31/14		Commodity Code	
Dim 1 2.5000	Dim 2 .0000	Dim 3 .0000	Heat I.D. 053468	Customer I.D. 001417	Customer Purchase Order P011200
Product Shape Rounds		Product Surface HR & Rough Turned			Customer Grade 17-4
Length (Inches) 132.000 Min. 156.000 Max.			Bill of Lading # 423604	Weight	

**Ship
To**Attention: Penn Stainless Prod
Tube Hollows International
39 Enterprise Dr.
Suite 2
Windham, ME 04062**Sold
To**VALBRUNA STAINLESS, INC.
2400 TAYLOR STREET WEST
FORT WAYNE, IN 46802

Specimen tested at longitudinal, mid-radius, room temperature.

Ultrasonic tested to ASTM A388 - Satisfactory.

Melted in Italy per DFARS clause 225.872-1.

Chemical testing to one or more of the listed ASTM methods:

E415-14, E1019-11, E1086-14.

Location of tensile fracture: inside middle of gage length.

No mercury or low melting alloy contamination. No weld repair.

Material melted and manufactured in the United States.

Material conforms to listed specifications and is DFARS compliant.

Quality system is compliant with ISO 9001:2008. Produced in accordance with EN 10204 3.1.

Results relate only to the items tested. Certification shall not be reproduced except in full, without written approval of Valbruna Stainless Inc. The recording of false, fictitious, or fraudulent statements on this document may be punished as a felony under federal statutes. Including Federal law Title 18, Chapter 47. Consult material safety data sheet (MSDS) for hazard info. I hereby certify that the reported figures are correct as contained in the records of the corporation.

Manager Laboratory Services

email: DHackett@valbruna.us

Dennis Hackett

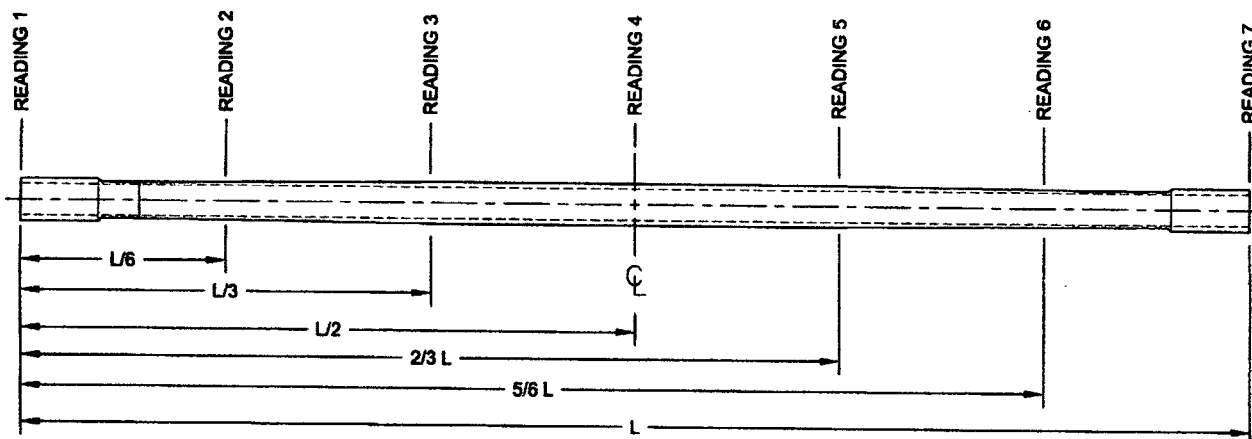
DART AEROSPACE LTD		Work Order:	
Description: Crosstube Assembly (AS350/355 High Fwd)		Part Number:	D350-748-141
Inspection Dwg: D350-748-141 Rev: H		Page 1 of 2	

FIRST ARTICLE INSPECTION CHECKLIST

	Inspection Sheet Drawing Dimension	Tolerance	Actual Dimension	Accept	Reject	Method of Inspection	Comments
SIDE A	2.240	+0.005/-0.000	2.237	/		vern	CNC-08
	2.180	+0.005/-0.000	2.180	-			
	2.180	+0.005/-0.000	2.180	-			
	2.237	+0.005/-0.000	2.237	-			
	2.272	+0.005/-0.000	2.274	-			
	2.306	+0.005/-0.000	2.308	-			
	2.339	+0.007/-0.000	2.341	-			
	2.339	+0.007/-0.000	2.341	-			
	0.062	+/-0.010	.062	-		vern	CNC-08
	5.25	+/-0.060	5.25	-		"	
	R0.063	+/-0.010	.063	-		RG	
	R0.50	+/-0.030	.500	-		"	
SIDE B	2.240	+0.005/-0.000	2.238	-		vern	CNC-08
	2.180	+0.005/-0.000	2.181	-			
	2.180	+0.005/-0.000	2.183	-			
	2.237	+0.005/-0.000	2.240	-			
	2.272	+0.005/-0.000	2.275	-			
	2.306	+0.005/-0.000	2.308	-			
	2.339	+0.007/-0.000	2.341	-			
	2.339	+0.007/-0.000	2.341	-			
	0.062	+/-0.010	.062	-		vern	CNC-08
	5.25	+/-0.060	5.25	-		"	
	R0.063	+/-0.010	.063	-		RG	
	R0.50	+/-0.030	.500	-		"	
	112.27	+/-0.060				type	LG ✓)

DART AEROSPACE LTD		Work Order:	
Description: Crosstube Assembly (AS350/355 High Fwd)		Part Number:	D350-748-141
Inspection Dwg: D350-748-141 Rev: H		Page 2 of 2	

WALL THICKNESS MEASUREMENT



Location	WALL THICKNESS MEASUREMENT (IN)				Deviation Δw (max-min)	TOLERANCE
	w1	w2	w3	w4		
READING 1 L= 0"	.123	.124	.125	.125	.002	0.030"
READING 2 L= 19	.128	.133	.135	.131	.007	
READING 3 L= 37	.175	.175	.177	.179	.004	
READING 4 L= 56	.177	.175	.176	.177	.002	
READING 5 L= 75	.176	.177	.177	.177	.001	
READING 6 L= 93	.134	.132	.133	.134	.002	
READING 7 L= 112	.128	.125	.127	.123	.004	

Calibration Result

Actual Block Thickness: .100 .500

SITESCAN 250 Measured Thickness: .100 .500

Measured by:	<i>MJ/ml</i>
Date:	<i>15/08/11</i>

Audited by:	<i>DAS</i> 9
Date:	<i>15-09-11</i>

Preliminary Approval:	
Date:	

Rev	Date	Change	Revised by	Approved
C	11.01.20	Dwg Rev updated (P/O D350-748-101)	KJ	
D	11.07.26	Tolerance revised for 2.339 dimensions	KJ	
E	12.06.04	Wall thickness form added	KJ	
F	13.05.08	Dimension 112.27 was 110.27	KJ	
G	14.04.25	5.25 dimension revised to 5.25	KJ	
H	15.04.14	Dwg Rev updated	KJ	<i>[Signature]</i>

Item	Qty	Part Number	Description
	-143		
	X	D350-748-143	CROSSTUBE ASSEMBLY (AS 350/355 HI FWD)
1	1	D6021-125	CROSSTUBE
2	2	D3502-1	SUPPORT
3	2	D5123-7	CLAMP CUSHION
4	1	AETC-1032	INSERT
5	2	MS21920-20 OR MS21920-21/-22	CLAMP (PER DART SPEC. M-MS21920-20/-21/-22)
6	1	NAS1149C0363R	WASHER (OR AN960C10)
7	1	NAS1635-3-8	SCREW (OR MS51958-63)
8	A/R	PROSEAL 890 B-2	SEALANT, AMS-S-8802 CLASS B-2

GENERAL NOTES:

- 1) MATERIAL: MANUFACTURED FROM D6021-125 (17-4PH)
FINISHED LENGTH AFTER TURNING = 112.270±0.06 (AFTER BENDING/TRIMMING = 110.27 REF)
- 2) FINISH: PRIME INSIDE AND OUTSIDE PER DART QSI 005 4.2
PAINT OUTSIDE PER DART QSI 005 4.2
- 3) TOLERANCE: PER DART QSI 018 UNLESS OTHERWISE NOTED.
WALL THICKNESS ECCENTRICITY PER DART QSI 038 7.2
MIN. ALLOWABLE WALL IS -0.020 FROM NOMINAL
- 4) UNITS: INCHES UNLESS OTHERWISE NOTED.
- 5) BREAK SHARP EDGES: 0.005 TO 0.010 MAX.
- 6) IDENTIFICATION: DART PART NUMBER "D350-748-143" AND BATCH NUMBER ON INSIDE OF CUFF
PER DART QSI 044 6.4 (VIBRATING STYLUS)
- 7) WEIGHT: 30.45 lbs
- 8) PART IS SYMMETRIC ABOUT CENTERLINE, EXCEPT FOR Ø0.290 HOLE.
- 9) EXTREME CARE MUST BE TAKEN TO PROTECT THE OUTSIDE SURFACE OF THE TUBE. THE OUTSIDE SURFACE MUST BE SMOOTH AND FREE FROM SURFACE DEFECTS SUCH AS SCRATCHES, NICKS, OR DENTS. DEFECTS UP TO 0.005" MAY BE BLENDED OUT LONGITUDINALLY. CIRCUMFERENTIAL GRIND MARKS ARE UNACCEPTABLE. WHEN DRILLING HOLES EXTREME CARE MUST BE TAKEN AND CAREFUL DEBURRING PERFORMED TO ENSURE A CLEAN HOLE WITH NO CRACKING/CHIPPING/GROOVES.

TURNING

- 10) BLEND OUT ALL EDGES FROM MACHINING LONGITUDINALLY, TRANSITION SHOULD BE SMOOTH. NOTE: ALL HOLES ARE DRILLED AFTER BENDING.

BENDING

- 11) BEND PROGRESSIVELY WITH A MINIMUM OF 7 PASSES PER SIDE. MAXIMUM TUBE FLATTENING DUE TO BENDING IS 8% BASED ON O.D. ON TOP HALF OF BEND, AND 8% ON BOTTOM HALF OF BEND.
- 12) MAX AMPLITUDE OF RIBBLING ALONG BENT PORTION OF THE TUBE IS 0.030 (ZN A1-3)
- 13) MAX TWIST: WITH XTUBE LAYED FLAT ON SURFACE, THE DIFFERENCE BETWEEN CUFF HEIGHTS FROM THE SURFACE MAY BE NO LARGER THAN 0.38 (ZN C1-3).

ASSEMBLY

- 14) TO INSTALL D3502-1 SUPPORT: ABRASE MATING SURFACE OF SUPPORT AND CROSSTUBE WITH 180-GRIT SANDPAPER AND REMOVE RESIDUE WITH MEK (OR EQUIVALENT). APPLY A 0.02" TO 0.05" THICK LAYER OF PROSEAL 890 CLASS B-2 (OR AMS-S-8802 CLASS B-2) SEALANT TO MATING SURFACE OF SUPPORT.
- 15) TORQUE CLAMPS 60 TO 80 IN.-LB. ENSURE AT LEAST 1.5 THREADS SHOWING IN SAFETY AND THAT NUT HAS NOT BOTTOMED-OUT AFTER TORQUING. PRIOR TO PACKAGING, RE-CHECK TORQUE ON CLAMPS AFTER PROSEAL 890 SEALANT HAS CURED FOR 72 HOURS.

UNDER REVIEW

Q 1514/24
URF 15-561

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2015 MAR 18

Q EN 15-547

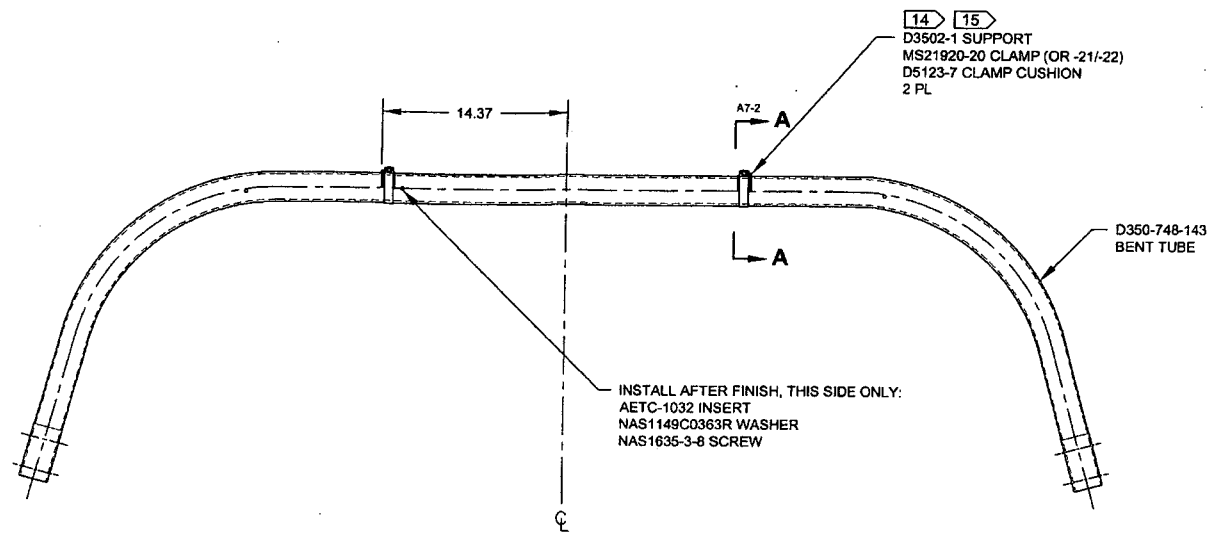
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MFG. APPR.			
APPROVED			
DE APPR.			
DATE	15.01.21		

DART AEROSPACE LTD HAWKESBURY, ONTARIO, CANADA	
DRAWING NO. D350-748-143	REV. A SHEET 1 OF 4
TITLE CROSSTUBE (AS 350/355 HI FWD)	SCALE NTS
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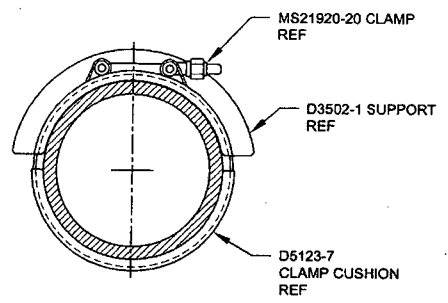
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**D350-748-143
ASSEMBLY DETAIL**



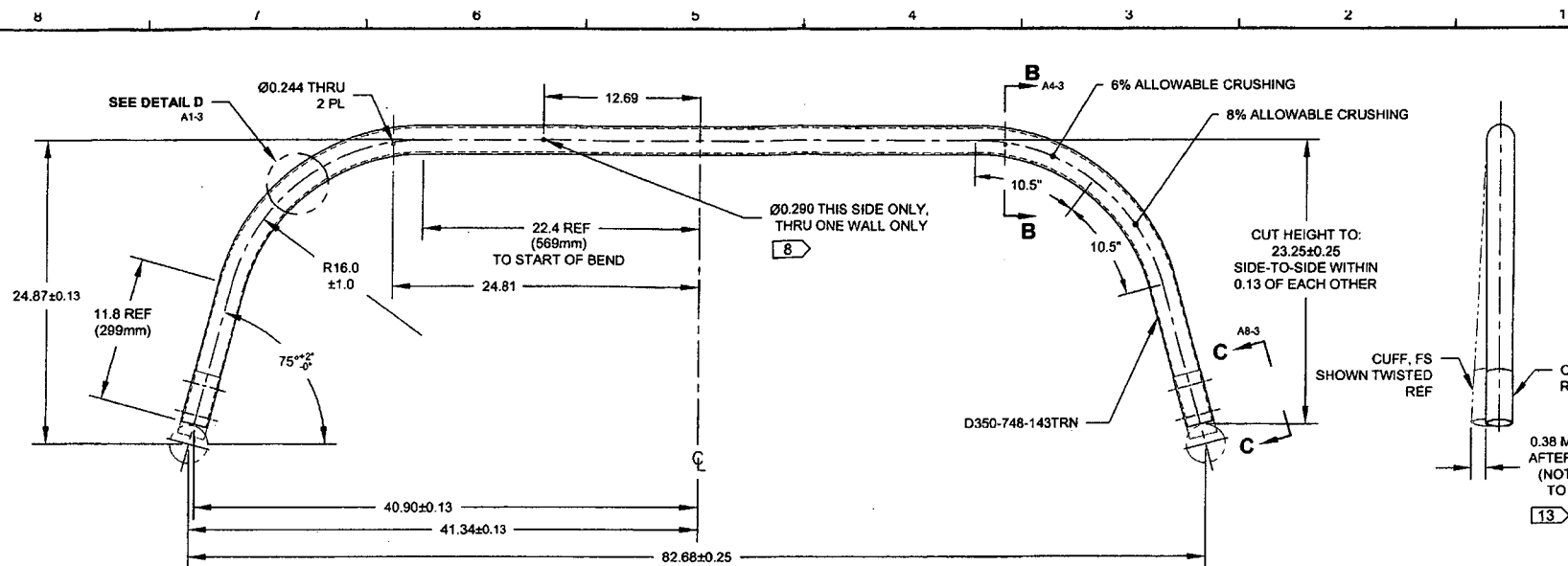
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UNDER REVIEW
4/15/23

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2015 MAR 18
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CHECKED	A.P.	DRAWING NO.	REV. A
MFG. APPR.	47	D350-748-143	SHEET 2 OF 4
APPROVED	47	TITLE	SCALE
DE APPR.	47	CROSSTUBE (AS 350/355 HI FWD)	NTS
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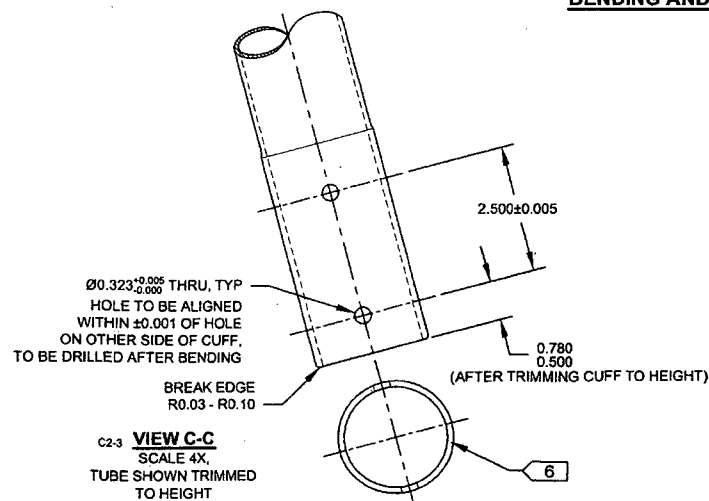
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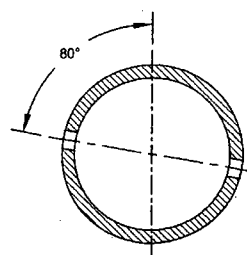
D350-748-143
BENDING AND DRILLING DETAIL 11

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2015 MAR 18



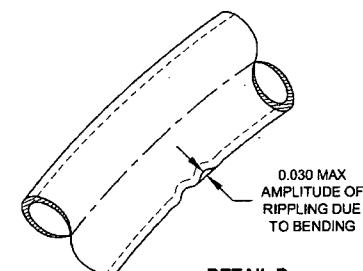
VIEW C-C
SCALE 4X
TUBE SHOWN TRIMMED
TO HEIGHT



SECTION B-B D3-3
SCALE 6X

UNDER REVIEW

15/4/28



DETAIL D D7-3
SCALE 4X
RIPPLING EXAGGERATED

DESIGN		DART AEROSPACE LTD	
DRAWN		HAWKESBURY, ONTARIO, CANADA	
CHECKED		DRAWING NO.	REV. A
MFG. APPR.		D350-748-143	SHEET 3 OF 4
APPROVED		TITLE	SCALE
DE APPR.		CROSSTUBE (AS 350/355 HI FWD)	NTS
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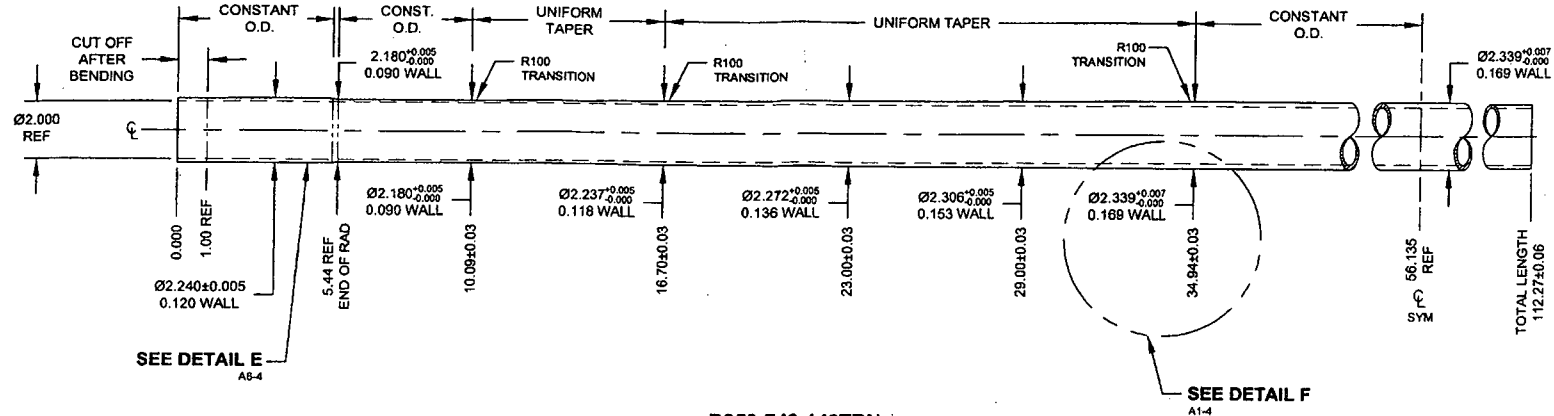
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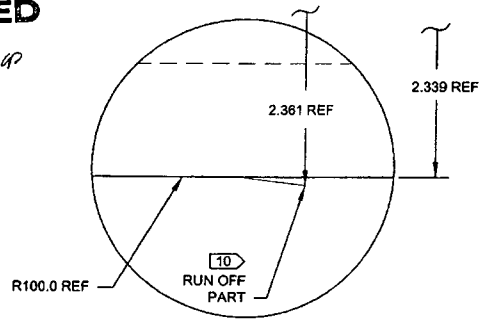
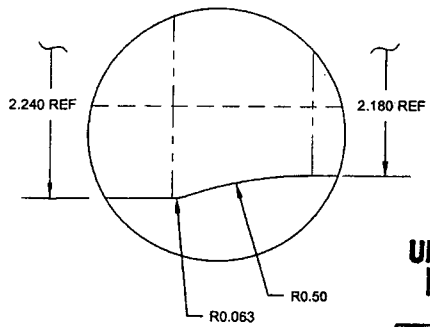
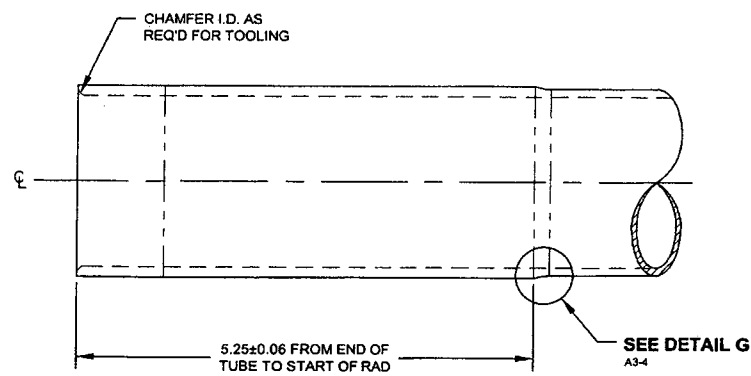
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D350-748-143TRN
TURNING DETAIL

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2015 MAR 18



UNDER REVIEW
15/14/24

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APPROVED	<i>[Signature]</i>	TITLE	SCALE
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8 7 6 5 4 3 2 1

Item	Qty -143	Part Number	Description
	X	D350-748-143	CROSSTUBE ASSEMBLY (AS 350/355 HI FWD)
1	1	D6021-125	CROSSTUBE
2	2	D3502-1	SUPPORT
3	2	D5123-7	CLAMP CUSHION
4	1	AETC-1032	INSERT
5	2	MS21920-20 OR MS21920-21-22	CLAMP (PER DART SPEC. M-MS21920-20/-21/-22)
6	1	NAS1149C0363R	WASHER (OR AN960C10)
7	1	NAS1635-3-8	SCREW (OR MS51958-63)
8	A/R	PROSEAL 890 B-2	SEALANT, AMS-S-8802 CLASS B-2

GENERAL NOTES:

- 1) MATERIAL: MANUFACTURED FROM D6021-125 (17-4PH)
FINISHED LENGTH AFTER TURNING = 112.270±0.06 (AFTER BENDING/TRIMMING = 110.27 REF)
- 2) FINISH: PRIME INSIDE AND OUTSIDE PER DART QSI 005 4.2
PAINT OUTSIDE PER DART QSI 005 4.2
- 3) TOLERANCE: PER DART QSI 018 UNLESS OTHERWISE NOTED
WALL THICKNESS ECCENTRICITY PER DART QSI 038 7.2
MIN. ALLOWABLE WALL IS -0.020 FROM NOMINAL
- 4) UNITS: INCHES UNLESS OTHERWISE NOTED.
- 5) BREAK SHARP EDGES: 0.005 TO 0.010 MAX.
- 6) IDENTIFICATION: DART PART NUMBER "D350-748-143" AND BATCH NUMBER ON INSIDE OF CUFF
PER DART QSI 044 6.4 (VIBRATING STYLUS)
- 7) WEIGHT: 30.45 lbs
- 8) PART IS SYMMETRIC ABOUT CENTERLINE, EXCEPT FOR Ø0.290 HOLE.
- 9) EXTREME CARE MUST BE TAKEN TO PROTECT THE OUTSIDE SURFACE OF THE TUBE. THE OUTSIDE SURFACE MUST BE SMOOTH AND FREE FROM SURFACE DEFECTS SUCH AS SCRATCHES, NICKS, OR DENTS. DEFECTS UP TO 0.005" MAY BE BLENDED OUT LONGITUDINALLY. CIRCUMFERENTIAL GRIND MARKS ARE UNACCEPTABLE. WHEN DRILLING HOLES EXTREME CARE MUST BE TAKEN AND CAREFUL DEBURRING PERFORMED TO ENSURE A CLEAN HOLE WITH NO CRACKING/CHIPPING/GROOVES.

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BENDING

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- 13) MAX TWIST: WITH XTUBE LAYED FLAT ON SURFACE, THE DIFFERENCE BETWEEN CUFF HEIGHTS FROM THE SURFACE MAY BE NO LARGER THAN 0.38 (ZN C1-3).

ASSEMBLY

- 14) TO INSTALL D3502-1 SUPPORT: ABRASE MATING SURFACE OF SUPPORT AND CROSSTUBE WITH 180-GRIT SANDPAPER AND REMOVE RESIDUE WITH MEK (OR EQUIVALENT). APPLY A 0.02" TO 0.05" THICK LAYER OF PROSEAL 890 CLASS B-2 (OR AMS-S-8802 CLASS B-2) SEALANT TO MATING SURFACE OF SUPPORT.
- 15) TORQUE CLAMPS 80 TO 80 IN-LB. ENSURE AT LEAST 1.5 THREADS SHOWING IN SAFETY AND THAT NUT HAS NOT BOTTOMED-OUT AFTER TORQUING. PRIOR TO PACKAGING, RE-CHECK TORQUE ON CLAMPS AFTER PROSEAL 890 SEALANT HAS CURED FOR 72 HOURS.

UNDER REVIEW

15/4/24
GRF 15.561

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2015 MAR 18

9 ECH 15-547

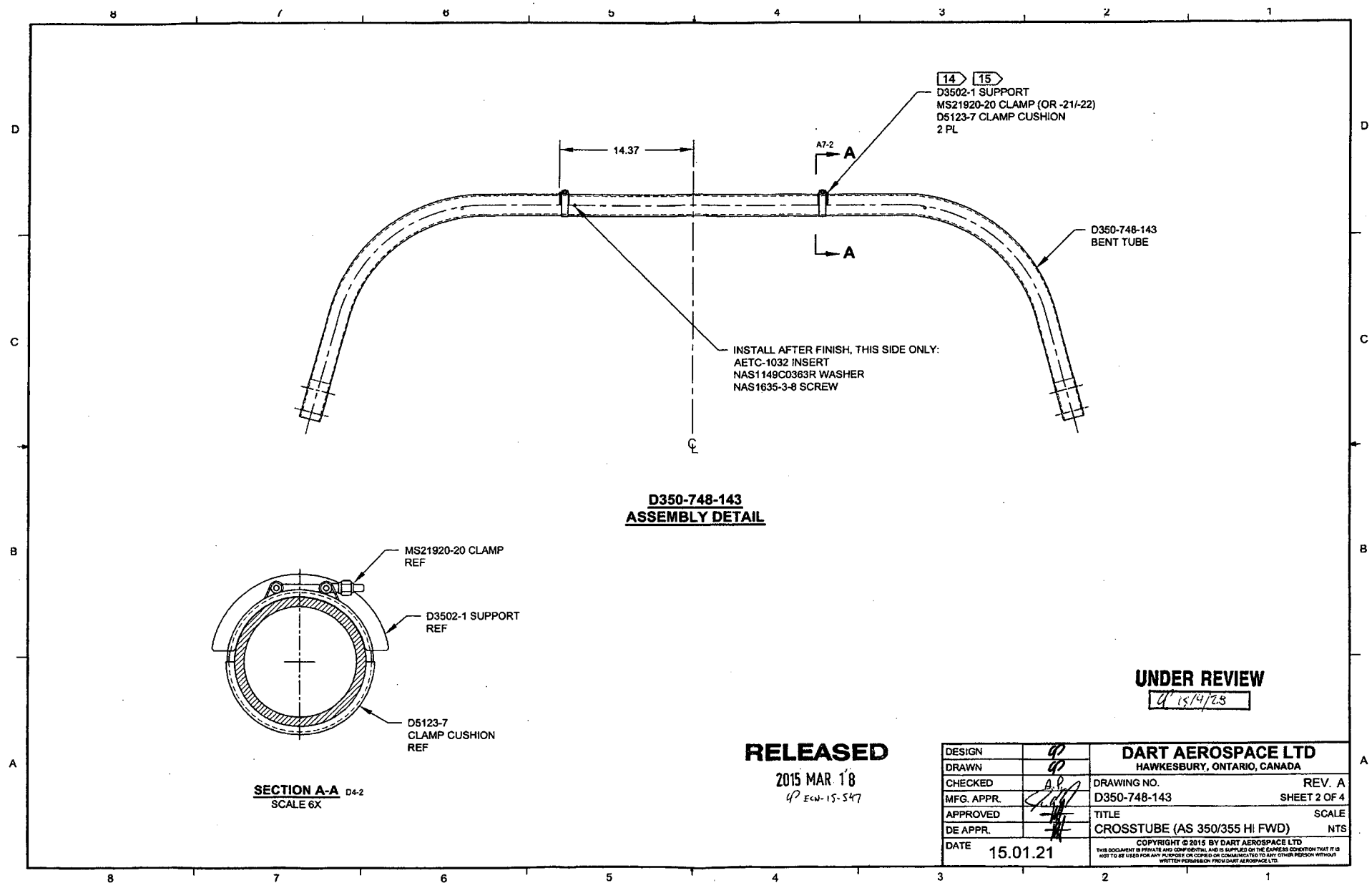
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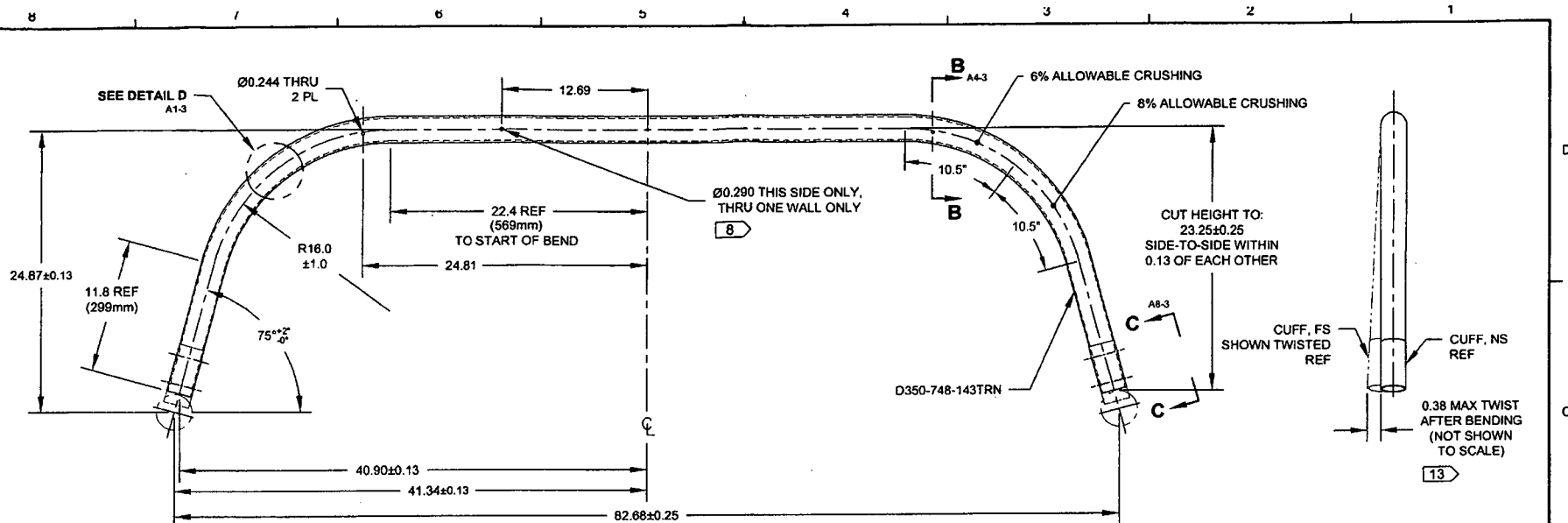
DART AEROSPACE LTD
HAWKESBURY, ONTARIO, CANADA

DRAWING NO. D350-748-143
SHEET 1 OF 4

TITLE CROSSTUBE (AS 350/355 HI FWD)
SCALE NTS

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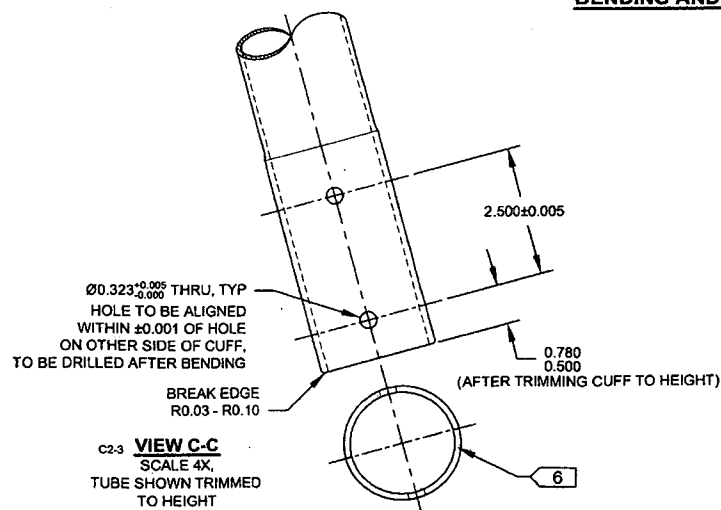




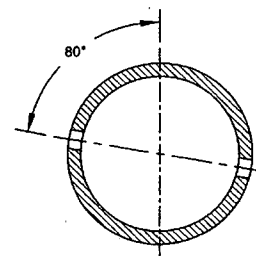
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BENDING AND DRILLING DETAIL 11

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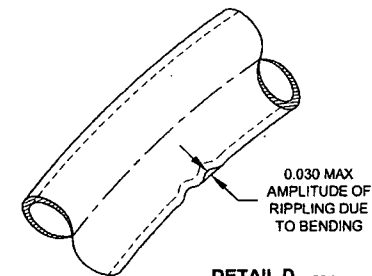
VIEW C-C
SCALE 4X,
TUBE SHOWN TRIMMED
TO HEIGHT



SECTION B-B D3-3
SCALE 6X

UNDER REVIEW

15/14/28



DETAIL D D7-3
SCALE 4X
RIPPING EXAGGERATED

DESIGN	qp	DART AEROSPACE LTD	
DRAWN	qp	HAWKESBURY, ONTARIO, CANADA	
CHECKED	A.P.	DRAWING NO.	REV. A
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APPROVED	<i>[Signature]</i>	TITLE	SCALE
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